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AN ESSAY ON Weighing of GOLD, &c.

WHEREIN IS SHEWN

An Effectual METHOD for diſcovering and detecting of Counterfeit Pieces of Money,

On the Principles of HYDROSTATICS.

Whereby not only Gold COINS, but alſo all Sorts of Gold and Silver PLATE may be weighed, and the intrinſic Value thereof aſcertained to the greateſt Nicety.

TO WHICH IS PREFIXED,

A very extenſive TABLE, wherein a great Number of Counterfeit Pieces of Metal, now circulating for genuine Gold, are deſcribed.

THE SECOND EDITION.

By WILLIAM SYMONS,
COLLECTOR OF EXCISE,
Author of THE PRACTICAL GAGER.

LONDON,
Printed for the AUTHOR,
And Sold by J. NOURSE, Bookſeller to HIS MAJESTY.
MDCCLXX.

ERRATA.

Page 5	*Line* 3	*read*	Flint Glaſs	2.600	1.371500	1.504620
	6		Plate ditto	2.575	1.358312	1.490152
	9		Green ditto	2.570	1.355675	1.487259
	11		Common dit	2.552	1.346180	1.476842
Page 10	*laſt Line*		*for* 0 0 0.0.2	*read* 0 0 0.0.½		
46	*laſt Line but* 4.		*for* 29	*read* 26		

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TO THE READER.

THE frequent Accounts that have occurr'd of late in the News Papers, of baſe and counterfeit Pieces of Money, which have been obſerved in diverſe Parts of this Kingdom, induced me to contrive a Method, which might effectually diſcover and detect ſuch adulterated Pieces of Coin, and prevent the Public from being impoſed upon by taking of them; by aſſign-ing the diſtinct Quantity of each different Metal whereof they are compounded, whether Gold, Silver, Braſs, &c. which I have attempted to do on the Principles of Hydroſtatics, it being the only ſafe Method that may be relied on, for proving the Goodneſs, and determining the intrinſic Value of any Piece of Metal whatſoever.

The uſual Way of weighing ſuch Pieces in the Air will not anſwer the End, for a Piece of Coin may be full Weight when weighed in Air, ring well, appear to the Eye to be pure Gold, and even anſwer the Touchſtone, and yet be adulterated to that Degree, as to have little or no Gold in it at all. But by the Method here propoſed, ſuch Pieces, however artfully diſguiſed, can by no Means eſcape without being diſcovered.

It was by this Means that *Archimedes*, the firſt Inventor of the Laws of Hydroſtatics, diſcovered the Cheat of the Artificer who had a certain Quantity of Gold delivered to him, in order to make a Crown for *Hiero*, King of *Syracuſe*, who embezzled Part of the Gold, and ſubſtituted in its room an equal Weight of Silver; but when he delivered the Work, which was curiouſly performed, there was a Suſpicion of Male Practice, upon which the Caſe was left to *Archimedes*, to ſurvey and determine whether or not the Workman had done Juſtice, without defacing the Work.

To do this, *Archimedes* made two Maſſes of equal Weight with the Crown, the one of Gold, and the other of Silver, which he immerſed ſeparately in a regular Veſſel of Water, and obſerved the different Room that each of theſe Bodies took up, by the different Riſe of the Water in the Veſſel.

And becauſe theſe two Maſſes took up the Room of different Quantities of Water, he inferred that they muſt conſiſt of different Specific Gravities, which by comparing with their Abſolute Gravities, he found each of their Specific Gravities with their Relation to that of Water.

He then ſerved the Crown in like Manner, and by comparing his Obſervations he detected the Cheat, and fairly aſſign'd the diſtinct Quantities of Gold and Silver contained in the Crown reſpectively.

There was an Inſtrument invented ſome Time ago, for weighing of Gold Coins, which is of the Steelyard Kind, and conſtructed on the Principles of Hydroſtatics; but on Account of the great Friction it is ſubject to, by reaſon of its turning on two Centers, it will not anſwer the End as well as a good Beam and Scales, *&c.* for a very ſmall Part of a Grain will alter the Equilibrium of a good Beam and Scales, which a Grain will ſcarcely do by this Inſtrument. And ſince the Value of every Grain of Gold that is deficient in the Hydroſtatic Weight is worth above three Shillings, we ought to determine the Hydroſtatic Weight of a Piece of Gold Coin within a ſmall Part of a Grain, if we intend to find its exact Value. But this will be effected exactly by a good Beam and Scales, with the Hydroſtatical Inſtrument herein deſcribed.

If the Pincers of this Inſtrument be not ſtrong enough to bear the Weight of any Piece of Plate to be immerſed and weighed in Water, you may get a Pair made of a Piece of Braſs, with a Screw to it in the Form of a Drawing Pen. And if you are not furniſhed with leſſer Weights than a Grain, you may eaſily make ſuch, by cutting a Piece of Writing Paper, juſt a Grain in Weight, into a Square, and dividing it by a Pair of Compaſſes into as many equal Parts as you pleaſe, *viz.* into 4, 8, or 10 Parts, ſo each Part will be $\frac{1}{4}$, $\frac{1}{8}$, or $\frac{1}{10}$ of a Grain. But any Perſon who is not already provided with Weights and Scales, may be ſupplied with them, and the Hydroſtatical Inſtrument, at the moſt reaſonable Prices, by Meſſrs. *Newton and Co.* Scale-makers, at the *Hand and Scales*, oppoſite the Church in *Bartholomew-Lane*, near the *Royal-Exchange*.

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A TABLE deſcribing counterfeit Pieces of Gold Coin, whereby they may be detected, without the Uſe of the Hydroſtatical Scale.

DESCRIPTIONS.	Dates.
DOUBLOONS, or £3 12 *ſh.*	
D and S inverted	1717
Ditto	1719
Letter M under the head.—Pale and bad gingle	1730
No letter under the head.— ditto.	1731
Ditto. ditto.	1741
JOHANNES, or 36 *ſh.*	
No letter under the head.—Pale and bad gingle	1730
Ditto. ditto.	1731
R & N. Full ſtop in the neck under the head.—Only ſilver gilt	1736
Ditto	1746
No letter under the head	1747
R under the head	1747
Ditto	1749
Ditto	1750
Ditto	1755
Ditto	1756
R & B under the head	1749
Ditto	1750
B under the head	1750
No letter under the head	1747
Ditto—Silver gilt	1748
Joſephus—Pale and bad gingle	1755
HALF JOHANNES, or 18 *ſh.*	
A good colour, very thick, and bad gingle	1734
G reverſed—Pale and bad gingle	1751
QUARTER JOHANNES, or 9 *ſh.*	
Pale and bad gingle	1757

MOI-

DESCRIPTIONS.	Dates.
MOIDORES, or 1*l.* 7 *ſh.*	
Petrus XI. Silver gilt	1703
Johannes V. Pale and bad gingle	1710
Ditto ditto	1717
Ditto ditto	1719
Ditto ditto	1721
Ditto ditto	1722
Ditto ditto	1727
Pale and old figures.	1728
GUINEAS, or £1 1 *ſh.*	
Geo. 1.—Pale colour	1715
Geo. 2.—Letters on the head ſide full and large, the reverſe ſmall and fine; the two fives like two S's	1755
Ditto. Faint impreſſion on both ſides, pale, and the figure 5 bad.	1757
Ditto. Pale colour	1758
Ditto. Thicker than common, and rough round the edge, but well executed.	1759
Sceptres imperfect, and of a yellowiſh colour.	Several dates.
Geo. 3. Quarterings on the reverſe cloſer ſtruck than in the genuine ones.	Ditto.
HALF MOIDORES, or 13 *ſh.* 6 *d.*	
Pale and bad gingle	1715
Ditto	1717
Ditto Silver gilt	1721
High colour—The T in PORT inverted	Several dates.
HALF GUINEAS, or 10 *ſh.* 6*d.*	
Pale and ſmall head	1756
Ditto	1757
QUARTER MOIDORES, or 6 *ſh.* 9*d.*	
Larger than common—The T in PORT inverted	Several dates.
QUARTER GUINEAS, or 5 *ſh.* 3*d.*	
Counterfeit metal;—ſome copper, and others ſilver ſtrongly gilt, and highly coloured, and weigh from 2*s.* 8*d.* to 3*s.* 2*d.*	Several dates.

N. B. *Many pieces bearing the above dates are good, therefore you are to beware only of thoſe that anſwer theſe deſcriptions.*

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ESSAY ON Weighing of GOLD, &c.

IN order to lay a proper Foundation to build our Theory upon, we muſt have recourſe to the following Univerſal Law in Hydroſtatics, which will hold good in all Caſes whatſoever, *viz.*

If any ſolid Body be firſt weigh'd in Air, and afterwards immerſed and weigh'd in Water or any other fluid Subſtance, it will loſe ſo much of its Weight in the Fluid, as the Weight of ſo much of the ſame Fluid as would fill up the Space taken up by the immerſed Solid.

Hence, if the Specific Gravity, or Weight of any Body (heavier than Water) in Air be known, the Hydroſtatic Weight, or its Weight in Water or any other Fluid, may eaſily be found; for it will be exactly ſo much leſs as a Quantity of the ſame Fluid equal in Weight to the immerſed Solid. Conſequently, if the Specific Gravity, or Weight of the Fluid, be ſubſtracted from the Specific Gravity, or Weight of the Solid, the Remainder will be the Hydroſtatic Weight of that Body, and their Difference will be the Standard by which the Goodneſs of the Metal, *&c.* may be tried.

Before I begin to make any Calculations, I ſhall ſubjoin a very extenſive Table of the Proportions of Specific Gravity, that ſeveral Bodies, both ſolid and fluid, bear to one another, with the Weight of a Cubic Inch of each Body, both in Troy and Averdupoiſe Weight; from whence may be deduced the Hydroſtatic Gravities of any of the Bodies therein mention'd.

The Table of Specific Gravity will not only be of uſe in making our Arithmetical Calculations for proving the Goodneſs, and trying the Value of Gold and Silver, but alſo in many other Reſpects; eſpecially in finding of the Solidities of Bodies, by having their Weights given; and, on the contrary, in find-

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ing their Weights by having their Solidities given.

For by knowing the Weight of any Body, the Solidity may be found; and *è contra*, by knowing the Solidity, the Weight may be found. But more of this hereafter.

The firſt Column of the Table ſhews the relative Gravities that Bodies bear to one another; as for Inſtance, if a Piece of fine Gold of a certain Magnitude weigh 19,640 Pounds, or Ounces, be what it will; a Piece of ſtandard Gold of the ſame Magnitude will weigh 18,888 Pounds or Ounces of the ſame, and ſo of the reſt. The two laſt Columns ſhew the Weight of a Cubic Inch of each of the Bodies according to their Title; as for Example, a Cubic Inch of Standard Gold weighs 9.963420 Oz. Troy, that is, nearly 10 Ounces; and 10.929478 Ounces of Avoirdupoiſe, or nearly 11 Ounces: And ſo for any other Body inſerted in the Table. The Proportion of Troy to Avoirdupoiſe Weight is as follows:

$$\left.\begin{array}{l}175\text{ lb Troy}\\175\text{ oz. ditto}\end{array}\right\}\text{ is equal to }\left\{\begin{array}{l}144\text{ lb Avoirdupoiſe}\\192\text{ oz. ditto}\end{array}\right.$$

From which it will be an eaſy matter to reduce any Number of Pounds or Ounces of Troy to Avoirdupoiſe, and *è contra*, of Avoirdupoiſe to Troy Weight.

SPECIES.	The relative Wt. of Bodies	Troy Weight Oz. Decimal Parts	Averdup. Wt. Oz. Decimal Parts
Fine Gold	19.640	10.360100	11.365668
Standard ditto	18.888	9.963420	10.929478
Lead	11.340	5.981850	6.562458
Fine Silver	11.092	5.851030	6.418940
Standard ditto	10.536	5.557740	6.097183
Copper	9.000	4.747500	5.208300
Ditto Halfpence	8.915	4.702662	5.159111
Fine Braſs	8.350	4.404625	4.832145
Caſt ditto	8.100	4.272750	4.687470
Steel	7.850	4.140875	4.542795
Iron	7.644	4.032210	4.423583
Pewter	7.471	3.940943	4.323468
Tin	7.320	3.861300	4.236084
Caſt Iron	7.000	3.692500	4.050900
Lead Oar	6.200	3.270500	3.587940
Lapis Calaminaris	5.000	2.637500	2.893500
Loadſtone	4.930	2.600575	2.852991
Diamonds	3.517	1.855217	2.035288
White Lead	3.160	1.666900	1.828692
Iſland Cryſtal	2.720	1.434800	1.574064
Marble	2.707	1.427942	1.566541
Pebble Stone	2.700	1.424500	1.562490
Coral	2.700	1.424500	1.562490
Jaſper	2.666	1.406315	1.542814

SPECIES.	The relative Wt. of Bodies	Troy Weight Oz. Decimal Parts	Averdup. Wt. Oz. Decimal Parts
Rock Cryſtal	2.650	1.397875	1.533555
Pearl	2.630	1.387325	1.521981
Flint Glaſs	2.567	1.354093	1.485523
Onyx Stone	2.510	1.324025	1.452337
Common Stone	2.500	1.318750	1.446750
Plate Glaſs	2.367	1.248592	1.369183
Glauber Salt	2.250	1.186875	1.302075
Cryſtal	2.210	1.165775	1.278927
Green Glaſs	2.133	1.125158	1.234367
Oiſter Shells	2.092	1.103530	1.210640
Common Glaſs	2.065	1.089288	1.195016
Brick	2.000	1.055000	1.157400
Earth	1.984	1.046560	1.148141
Nitre	1.900	1.002250	1.099530
Vitriol	1.880	.991700	1.087956
Alabaſter	1.874	.988535	1.084484
Horn	1.840	.970600	1.064808
Ivory	1.820	.960050	1.053234
Brimſtone	1.800	.949500	1.041660
Chalk	1.793	.945807	1.037609
Gravel	1.755	.925763	1.015619
Borax	1.717	.905717	.993628
Allum	1.714	.904135	.991892
Clay	1.712	.903080	.990734

SPECIES.	The relative Wt. of Bodies	Troy Weight Oz. Decimal Parts	Averdup. Wt. Oz. Decimal Parts
Dry Bone	1.660	.875650	.960642
Human Calculus	1.542	.813405	.892355
Sand	1.520	.801800	.879624
Gum Arabic	1.400	.738500	.810180
Opium	1.350	.712125	.781245
Lignum Vitæ	1.327	.699993	.767935
Coal	1.250	.659375	.723375
Jet	1.238	.653045	.716431
Ebony	1.177	.620868	.681130
Pitch	1.150	.606625	.665505
OldCheſh.cheeſe	1.101	.580775	.637148
Mahogany Wood	1.063	.560733	.615158
Amber	1.040	.548600	.601848
Brazil Wood	1.031	.543853	.596638
Box ditto	1.030	.543325	.596061
Camphire ditto	.996	.525300	.576385
Bees Wax	.955	.503763	.552659
Wood Aſhes	.936	.493740	.541663
Oak	.920	.485300	.532404
Logwood	.913	.481608	.528353
Ice	.908	.478970	.525460
Bay Salt	.868	.457870	.502312
Beech Wood	.854	.450665	.494210
Aſh ditto	.820	.432550	.474534

SPECIES.	The relative Wt. of Bodies	Troy Weight Oz. Decimal Parts	Averdup. Wt. Oz. Decimal Parts
White Peaſe	.811	.427803	.469325
Field Beans	.811	.427803	.469325
Wheat, beſt Sort	.779	.410923	.469807
Holly Wood	.777	.409867	.449650
Yew ditto	.760	.400900	.439812
Maple ditto	.755	.398262	.436918
Elm ditto	.750	.395625	.434025
White Sea Salt	.702	.370305	.406247
Crabtree Wood	.700	.369250	.405090
Plumbtree ditto	.663	.349733	.383678
Barley	.663	.349733	.383678
Walnut-tree	.631	.332853	.365160
Cedar Wood	.613	.323358	.354743
Wheat Meal unſifted	.498	.262695	.288193
Malt 2 months old	.485	.255838	.280670
White Oats	.474	.250035	.274304
Rye Meal unſift^{d}	.441	.232628	.255207
Firtree Wood	.280	.147700	.162036
Cork	.238	.125545	.137731
FLUIDS.			
Quickſilver	14.000	7.565000	8.101800
Oil of Vitriol	1.700	.896750	.983790
Oil of Tartar	1.550	.817625	.896985
Honey	1.450	.782875	.839115
Spirit of Nitre	1.315	.739113	.760991

SPECIES.	The relative Wt. of Bodies	Troy Weight Oz. Decimal Parts	Averdup. Wt. Oz. Decimal Parts
Aqua Fortis	1.300	.685750	.752310
Aqua Regis	1.234	.650935	.714116
Aſh Lees	1.167	.615593	.675343
Spirit of Urine	1.120	.590800	.648144
Made Brine	1.109	.584998	.641778
Human Blood	1.054	.556165	.609948
Sack	1.033	.544908	.597797
Urine	1.032	.544380	.597218
Milk	1.031	.543853	.596640
Sea Water	1.030	.543325	.596061
Serum of Human Blood	1.030	.543325	.596061
Ale	1.028	.542270	.594904
Vinegar	1.026	.541215	.593746
Cyder	1.026	.541215	.593746
Common Water	1.000	.527500	.578700
Diſtill'd Waters	.993	.523808	.574649
Red Wine	.990	.522225	.572913
Linſeed Oil	.932	.491630	.539348
Brandy	.927	.488993	.536455
Olive Oil	.913	.481608	.528353
Spt of Turpentine	.874	.461035	.505784
Spirit of Wine	.866	.456815	.501154
Oil of Turpentine	.810	.427275	.468747
Common Air	.0012	.000633	.000694

Before I begin to ſhew the Method of proving the Goodneſs, and trying the Value of Gold and Silver by the Laws of Hydroſtatics, it will be neceſſary to ſettle the Value of Gold and Silver Coins, both with reſpect to their Weight, and the Pureneſs of the Metal whereof they are made.

The Standard of *England* for Gold Coin is according to the following Proportion, *viz.* 11 Ounces of fine Gold, and one Ounce of Alloy, that is, one Pound Troy Weight of Gold is coined into 44 Guineas and a half.

The Standard for Silver is 11 Ounces and 2 Pennyweights of fine Silver, and 18 Pennyweights of Alloy, that is, one Pound Weight Troy is coined into 3 Pounds 2 Shillings.

And the Standard for Copper is, one Pound Troy of Copper is coined into 46 Half-pennies, or 23 Pence.

N. B. Three new Copper Half-pennies weigh nearly one Ounce Averdupoiſe Weight.

And the Weights of *Engliſh* Gold and Silver Coins, as they come out of the Mint, are according to the following Table.

			Pwt.	Gr.
A	5 Guinea Pce	weighs	26	21
	2 Guinea Pce		10	18
	1 Guinea		5	9
	½ Guinea		2	16½
	1 Crown Pce		19	8½
	½ Crown		9	16¼
	1 Shilling		3	22
	6 Pence		1	23

Altho' the Static Weight of a new Standard Guinea be 5 Pennyweights 9 Grains, equal to 129 Grains; yet by reaſon of Loſs in wearing and carrying, they may at a mean be eſtimated at 126 Grains, which is 3 Grains leſs than the Standard; and the other Diviſions may be taken in the ſame Proportion, ſo that according to this Weight of a Guinea

			l.	s.	d.
One	Pound of Gold	will be worth	48	0	0
	Ounce of Ditto		4	0	0
	Pwt. of Ditto		0	4	0
	Grain of Ditto		0	0	2

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And the Value of Silver will be as follows:

			l.	s.	d.
One	Pound of Silver	will be worth	3	2	0
	Ounce of Ditto		0	5	2
	Pwt. of Ditto		0	0	3.0.$\frac{2}{5}$
	Grain of Ditto		0	0	0.0.2

Having ſhewn the Specific Gravity of Gold and Silver, or its Weight in Air, alſo its Standard Value, I ſhall in the next Place ſhew the Method of finding its Hydroſtatic Weight, or the Weight it ſhould weigh in Water, provided it were of equal Goodneſs with the Standard.

1. To find the Hydroſtatic Weight of any Piece or Maſs of Gold, the Proportion is as follows.

As the Specific Gravity of Standard Gold, *viz.* 18.888 is to the Difference between that and the Specific Gravity of Water, *viz.* 17.888, ſo is the Static Weight, or the Weight of any Piece of Gold in Air, to its Hydroſtatic Weight, or its Weight in Water.

Example 1.

To find the Hydroſtatic Weight of 6 Grains of Gold.

$$18.888 : 17.888 :: \overset{\text{Static Grains}}{6} : \overset{\text{Hydroſ. Grains}}{5.68} = \text{wt. required.}$$

6

18.888) 107,328 (5.68

94440

128880

113328

155520

151104

4416

Example 2.

To find the Hydroſtatic Weight of a new Guinea, whoſe Static Weight is 129 Grains.

$$18.888 : 17.888 :: \overset{\text{Static Grains}}{129} : \overset{\text{Hydroſ. Grains}}{122.17} = \text{weight (ſought}$$

129
———
160992
35776
17888
———
18.888) 2307552 (122.17
18888
———
41875
37776
———
40992
37776
———
32160
18888
———
132720
132216
———
504

Example 3.

To find the Hydroſtatic Weight of an old Guinea, that is diminiſhed 3 Grains by wearing, *&c.* as

```
                     Static  Hydroſ.
                     Grains  Grains
18.888 : 17.888 :: 126 : 119.33 = wt required
```

By this Method the Hydroſtatic Weight of any Piece or Maſs of Gold may be found to the greateſt Nicety; but for the Sake of whole Numbers, we may, inſtead of 18.888 to 17.888, make uſe of the Proportion as 19 is to 18, which will come pretty near the Truth, and much ſhorten the Operation, as will be ſeen by working of the ſecond Example over again.

```
             Static  Hydroſ.
             Grains  Grains
19 : 18 ::   129  :  122 4/19 = Hydroſt. Weight
              18
            ----
            1032
            129
            ----
       19)  2322 (122.
            19
            ---
             42
             38
            ----
              42
              38
            ----
               4
```

This Method gives the Hydroſtatic Weight of a Piece of Gold a ſmall Matter too much; however, as the Difference is ſo very inconſiderable, it may be made uſe of without any ſenſible Error in finding the Hydroſtatic Weight of any Piece of Gold not ſpecified in the following Tables.

The Hydroſtatic Weight of any Piece of Gold may be alſo found in another Manner, *viz.* By reducing the Weight of a Cubic Inch of Gold into Grains, which will be 4782; and alſo that of a Cubic Inch of Water, which will amount to 253 Grains: And then the Proportion will be as follows.

As the Grains in a Cubic Inch of Gold are to the Difference of Grains betwixt them and a Cubic Inch of Water; ſo are the Grains that any Piece of Gold weighs in Air to the Grains that it ſhould weigh in Water.

As for Example:

To find the Hydroſtatic Weight of a Johannes, whoſe Weight in Air is 9 Pwts. 5 Gr. equal to 221 Grains.

Static Grains Hydroſ. Grains

$4782 : 4529 :: 221 : 209\frac{1471}{4782}$ = wt. ſought

```
       4529
        221
      -----
       4529
      9058
     9058
     -------
4782)1000909(209
     9564
     -----
      44509
      43038
      -----
       1471
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The Reſult would be very near the ſame if this had been wrought by the former Method, therefore I ſhall produce no more Examples, but leave it to every one's own Option to chuſe that Method which he likes beſt. But for this Purpoſe, in order to ſave Trouble, I have calculated the two following Tables. The firſt of which ſhews the Static and Hydroſtatic Weight of any Piece or Maſs of Gold by Inſpection, from one Grain to twelve Ounces; and to the Value of 48 Pounds, at the Rate of 2d. per Grain.

But 2d. per Grain for Gold is rather too much, as we ſhall ſee by the following Calculation; for if 129 Grains are worth 21 Shillings, what is one Grain worth?

Grains Shill. Gr. Pence
129 : 21 :: 1 : 1$\frac{3}{4}$.814 fere
12

129) 252(1=Pence
129

123
4

129) 492 (3.813 = Farthings
387

1050
1032

180
129

510
387

123

From whence it appears that the Value of a Grain of Gold is 1d. $\frac{3}{4}$. 814 fere, *viz.* it wants about 186 Thouſand Parts of a Farthing of 2d. per Grain, which is not material to our Purpoſe. The other Table contains the Static and Hydroſtatic Weight of all the noted Gold Coins current in *England*, with their Value, and Difference of Weights in Air and Water.

A TABLE of the STATIC and HYDROSTATIC WEIGHT of GOLD

Value		Static Weight		Hydroſtat. wt.		Value		Static Weight		Hydroſtat. wt.		Value		Static Weight		Hydroſtat. wt.		Value		Static Weight			Hydroſtatic Weight		
l.	s.	pwt	gr.	pwt.	gr.	l.	s.	pwt.	gr	pwt.	gr.	l.	s	pwt.	gr.	pwt	gr	l	s	oz.	pwt.	gr.	oz.	pwt.	gr.
	1	0	6	0	5¾	1	3	5	18	5	10¾	2	5	11	6	10	15¾	3	7	0	16	18	0	15	20¾
	2	0	12	0	11⅓	1	4	6	0	5	16½	2	6	11	12	10	21⅓	3	8	0	17	0	0	16	2½
	3	0	18	0	17	1	5	6	6	5	22	2	7	11	18	11	3	3	9	0	17	6	0	16	8
	4	1	0	0	22¾	1	6	6	12	6	3¾	2	8	12	0	11	8¾	3	10	0	17	12	0	16	13¾
	5	1	6	1	4½	1	7	6	18	6	9½	2	9	12	6	11	14½	3	11	0	17	18	0	16	19½
	6	1	12	1	10	1	8	7	0	6	15	2	10	12	12	11	20	3	12	0	18	0	0	17	1⅛
	7	1	18	1	15¾	1	9	7	6	6	20¾	2	11	12	18	12	2	3	13	0	18	6	0	17	6¾
	8	2	0	1	21½	1	10	7	12	7	2½	2	12	13	0	12	7½	3	14	0	18	12	0	17	12½
	9	2	6	2	3	1	11	7	18	7	8¼	2	13	13	6	12	13¼	3	15	0	18	18	0	17	18¼
	10	2	12	2	8¾	1	12	8	0	7	14	2	14	13	12	12	19	3	16	0	19	0	0	17	23¾
	11	2	18	2	14½	1	13	8	6	7	9¼	2	15	13	18	13	0½	3	17	0	19	6	0	18	5½
	12	3	0	2	20¼	1	14	8	12	8	1½	2	16	14	0	13	6¼	3	18	0	19	12	0	18	11¼
	13	3	6	3	2	1	15	8	18	8	7	2	17	14	6	13	12	3	19	0	19	18	0	18	17
	14	3	12	3	7½	1	16	9	0	8	12½	2	18	14	12	13	17½	4	0	1	0	0	0	18	22½
	15	3	18	3	13¼	1	17	9	6	8	18¼	2	19	14	18	13	23¼	8	0	2	0	0	1	17	21
	16	4	0	3	19	1	18	9	12	9	0	3	0	15	0	14	5	12	0	3	0	0	2	16	9¼
	17	4	6	4	0½	1	19	9	18	9	5½	3	1	15	6	14	10½	16	0	4	0	0	3	15	18⅓
	18	4	12	4	6⅓	2	0	10	0	9	11⅓	3	2	15	12	14	16⅓	20	0	5	0	0	4	14	18
	19	4	18	4	12	2	1	10	6	9	17	3	3	15	18	14	22	24	0	6	0	0	5	13	15½
1	0	5	0	4	17½	2	2	10	12	9	22¾	3	4	16	0	15	3¾	32	0	8	0	0	7	11	12¾
1	1	5	6	4	23⅓	2	3	10	18	10	4⅓	3	5	16	6	15	9⅓	40	0	10	0	0	9	9	9¼
1	2	5	12	5	5	2	4	11	0	10	10	3	6	16	12	15	15	48	0	12	0	0	11	7	8

A TABLE of the Static and Hydroſtatic Weight of Gold Coins, with their Value and Difference.

Species.	Value.			Stat. w^t		Hyd. w^t		differ^{ce}	
	l.	s.	d.	Pw^t	Gr	Pw^t	Gr	Pw^t	Gr.
$\frac{1}{16}$ of a Moidore	0	2	8$\frac{1}{4}$.6	0	16$\frac{2}{3}$	0	15$\frac{3}{4}$	0	1
$\frac{1}{8}$ of ditto	0	3	4$\frac{1}{2}$	0	20$\frac{3}{4}$	0	19$\frac{3}{4}$	0	1
$\frac{1}{8}$ of a Johannes	0	4	6	1	3$\frac{5}{8}$	1	2$\frac{1}{6}$	0	1$\frac{1}{2}$
$\frac{1}{4}$ of a Moidore	0	6	9	1	17$\frac{1}{2}$	1	15$\frac{1}{6}$	0	2$\frac{1}{8}$
$\frac{1}{4}$ of a Johannes	0	9	0	2	7$\frac{1}{4}$	2	4$\frac{1}{3}$	0	3
$\frac{1}{2}$ of a Guinea	0	10	6	2	16$\frac{1}{2}$	2	13	0	3$\frac{1}{2}$
$\frac{1}{2}$ of a Moidore	0	13	6	3	11$\frac{1}{8}$	3	6$\frac{3}{4}$	0	4$\frac{1}{3}$
$\frac{1}{2}$ of a Johannes	0	18	0	4	14$\frac{1}{2}$	4	8$\frac{5}{6}$	0	5$\frac{3}{4}$
a Guinea	1	1	0	5	9	5	2$\frac{1}{8}$	0	6$\frac{7}{8}$
a Moidore	1	7	0	6	22$\frac{1}{4}$	6	13$\frac{1}{2}$	0	8$\frac{3}{4}$
a Johannes	1	16	0	9	5	8	17$\frac{1}{3}$	0	11$\frac{2}{3}$
a 2 Guinea Piece	2	2	0	10	18	10	4$\frac{1}{3}$	0	13$\frac{2}{3}$
a 2$\frac{1}{2}$ Moidore Pce	3	7	6	17	7$\frac{1}{2}$	16	9$\frac{5}{8}$	0	21$\frac{7}{8}$
a double Johannes	3	12	0	18	10	17	10$\frac{2}{3}$	0	23$\frac{1}{3}$
a 5 Guinea Pce	5	5	0	26	21	25	10$\frac{7}{8}$	1	10$\frac{1}{8}$
a 5 Moidore Pce	6	15	0	34	15$\frac{1}{4}$	32	19$\frac{1}{4}$	1	20

* If any Piece or Maſs of Gold upon Trial proves to be full Weight both in Statics and in

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* *Note*, The Number that I have made uſe of for the Specific Gravity of Standard Gold in my Calculations, *viz.* 18.888, is according to Mr. *Cotes*'s, Mr. *Emerſon*'s, &c. Tables, which Number does not exactly agree with my Experiments, it being rather too great; for on weighing a new Guinea in Air, I found it to be exactly 5 Pennyweights 9 Grains; and the ſame Guinea weigh'd in Water, juſt 5 Pennyweights 2 Grains; ſo that the Difference is exactly 7 Grains. Now if the Static Weight of this Guinea be divided by this Diffe-

Hydroſtatics, according to the two preceding Tables, we may depend upon its being genuine,

D 2 and

Difference, the Quotient will be 18.42857, the Specific Gravity of this Guinea, which is ſomewhat leſs than the above Number.

And in general I found the common Difference of the Weights of Guineas when weighed in Air and Water to be about 7 Grains.

I alſo made ſeveral Experiments on *Portugal* Pieces of Gold, where I found a greater Difference than before, for a Johannes that weighed in Air 9 Pennyweights 5 Grains, weigh'd exactly in Water 8 Pennyweights $16\frac{1}{2}$ Grains, ſo that the Difference is $12\frac{1}{2}$ Grains: By which if the Static Weight of the Piece be divided, it will quote 17.68 for the Specific Gravity of Portugal Gold. And in general I found the different Weights of Johannes's when weigh'd in Air and Water to be about $12\frac{1}{2}$ Grains, and their doubles, *viz* 3*l.* 12*s.* Pieces, 25 Grains, or 1 Pennyweight and 1 Grain.

I likewiſe tried the Moidores in the ſame manner, and found the common Difference of their Weights when weighed in Air and Water to be about $9\frac{2}{5}$ Grains. What I would infer from hence is this, that notwithſtanding the Difference of Weights of Gold Coins, when weigh'd in Air and Water, may exceed the Difference in the above Table, they may not in any wiſe be adulterated, provided that Difference is not more in Proportion than 7 Grains to a Guinea, $9\frac{2}{5}$ Grains to a Moidore, and $12\frac{1}{2}$ Grains to a Johannes.

and in no wiſe adulterated; but if it is full Weight when weighed in Air, and there be a Deficiency when weighed in Water, it is certain there muſt have been ſome Adulteration made.

The next Point that comes under Conſideration is, to find the Quantity of Adulteration, or how much Gold and how much of a baſer Metal is mix'd together, in order to adulterate or depreciate its Value.

The Adulteration may be made either with Silver, Copper, Braſs, or Tin; but ſuppoſing it to be made with Silver, as that is the fitteſt Metal for the Purpoſe, becauſe the Specific Gravity of Silver is the neareſt of any to that of Gold, and the Fraud will have the greater Probability of paſſing undiſcovered; but the Cheat may be detected by weighing the Compound Piece of Metal in Air and Water, and the diſtinct Quantity of Gold and Silver contained in it will be found very near, by the following Method.

* Multiply the Hydroſtatic Weight of the Piece by 399, and its Static Weight by 361. Then

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* This Rule is deduced in the following Manner, where I put a = Weight of the Compound in Air. b = its Weight in Water. $g = 19$ = Specific Gravity of Gold. $k = 18$ = its Difference

Then ſubtract the latter Product from the former, and divide the Remainder by 17, which will quote the Grains of Gold in the Piece, and that ſubtracted from the Static Weight, will leave the Grains of Silver.

Example.

Admit a Piece compounded of Gold and Silver to weigh in Air 18 Pennyweights 10 Grains, or 442 Grains; and in Water 17 Pennyweights and 2 Grains, or 410 Grains, Quere the diſtinct Quantity of Gold and Silver contain'd in this Piece?

Difference from that and Water. $S=21=$ double the Specific Gravity of Silver. $r=19=$ double the Difference from that and Water. Put $x=$ Quantity of Gold in the Piece, then will $a-x=$ the Quantity of Silver.

And $g : k :: x : \frac{kx}{g}$ and $S : r :: a-x : \frac{ar-xr}{S}$

Then will $\frac{kx}{g}+\frac{ar-xr}{S}=b$ and $x=\frac{bsg-agr}{sk=gr}=$ the Quantity of Gold. In this Theorem $sg : gr$, and sk, are always conſtant, let the Value of a and b vary ever ſo much. Therefore in Numbers it will become

$$\frac{b\,399-a\,361}{17}=\text{to } x \text{ as before}$$

This Theorem may alſo be applied to the finding of the diſtinct Quantity of Metal in any other Compoſition, provided the Values of the Letters $g\,k\,s\,r$ be charged according to the Specific Gravities of the Bodies compounded.

1ſt Factor = 399 — 2d Factor=361
Hydroſt. wt. = 410 — Static wt. = 442

3990 — 722
1596 — 1444
1444

1ſt Product= 163590
2d Product= 159562 — 2d Product 159562

17) .4028 ($236\frac{16}{17}$=Grains Gold
34 — 442=Static wt. of Pce
62 — $205\frac{1}{17}$ =Gr. of Silver
51
118
102
16

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By which it appears that this Piece conſiſts of $236\frac{16}{17}$ Grains of Gold, and $205\frac{1}{17}$ Grains of Silver; ſo there is a Deficiency in it of $205\frac{1}{17}$ Grains of Gold, which at 2*d.* per Grain amounts to 1*l.* 14*s.* $20\frac{1}{2}$qr. but inſtead thereof, there is ſo much Silver added to make up the Static Weight, which at a half Farthing a Grain is worth 2*s.* and $1\frac{1}{2}$*d.* $\frac{1}{2}$qr. ſo that the Piece is only depreciated 1*l.* 12*s.* $\frac{1}{2}$*d.*

In order to ſave the Trouble of Calculation on every Occaſion, I ſhall inſert the following Table, which will ſhew by Inſpection the Value of the Deficiency, or Gold wanting, from one to thirty Grains, which is made in the following Manner.

We have already found that a Guinea weighing in Air 129 Grains, will weigh in Water 122.17 Grains. Now if the Weight of 129 Grains of Silver in Water (which will be 116.756 Grains, as will be ſhewn hereafter) be taken from it, the Remainder will be the whole Difference in Hydroſtatics between Silver and Gold, as may be ſeen below.

Grains
From 122.170 = wt. of 129 Gr. of Gold in Water
Subtract 116.756 = wt. of 129 Gr. of Silver in Water

Difference . . 5.414 = Deficiency of Gold in the Silver Pce

Since the whole Difference of two Pieces of equal Weight of Gold and Silver, weighing 129 Grains in Air, will, when weighed in Water, be 5.414 Grains, therefore the Deficiency of Gold in the latter muſt amount to 21 Shillings. And if 5.414 Grains amount to 21 Shillings, what will one Grain amount to at that Rate?

Hydroſ.

```
Hydroſ.          Hydroſ.
Grains   Shil.   Grain     s. d.
5.414  :  21  ::  1  :  3 : 10½.184 fere
          12
        ------
         252
           4
        -------
  5.414)1008.000(186.183=Farthings
        5414       46.½.183=Pence
        -------
        46660
        43312
        -------
         33480
         32484
        -------
          9960
          5414
          -------
          45460
          43312
           -------
           21480
          16242
          -------
            5238
```

By which it appears, that every Grain that is wanting in the Hydroſtatic Weight of any Piece of Gold, is worth 3*s.* 10½*d.* when the Mixture is made with Silver, but if the Adulteration is made of a baſer Metal, ſuch as Copper, Braſs, &c. then the Value of the Deficiency will be leſs, as might eaſily be made appear; for if the Deficiency of any Piece or Maſs of Gold that is adulterated, when weigh'd in Water amounts to as much as the Difference of the Hydroſtatic Gravities of ſuch a Quantity of Gold and Silver, then its plain that there is no Gold in it, but it is made entirely of Silver. And if the Deficiency is ſtill greater than that Difference, then it muſt be made of ſome baſer Metal than Silver, and conſequently, the Grains deficient muſt be of leſs Value.

The Table is calculated on Suppoſition that the Adulteration is made with Silver, but then as there muſt be a ſufficient Quantity of Silver in the Mixture to ſupply the Place of the Gold that is wanting, in order to make up the Static Weight of the Piece, there muſt be an Allowance made for the Silver, which will require about a Pennyweight for every Grain that is wanting in the Hydroſtatic Weight of the Piece, and a Pennyweight of Silver is worth about 3*d.* ſo that inſtead of 3*s.* 10½*d.* per Grain, it will be depreciated no more than 3*s.* 7½*d.* per Grain.

If the Adulteration be made of ſome baſer Metal than Silver, then there muſt be no Allowance made for the Metal that is mix'd with the Gold, becauſe it will be worth little or nothing, and the Value of a Grain deficient if made with

		s.	*d.*
Copper	will be worth	2	8¾
Braſs		2	3½
Tin		1	11½

A TABLE ſhewing the Value of the Deficiency of Gold by the Hydroſtatic Weight when it is adulterated with Silver.

Grains wanting	Value			Grains wanting	Value			Grains wanting	Value		
	l.	s.	d.		l.	s.	d.		l.	s.	d.
1	0	3	10½	11	2	2	8	21	4	1	5¼
2	0	7	9	12	2	6	6½	22	4	5	4
3	0	11	7½	13	2	10	5	23	4	9	2½
4	0	15	6	14	2	14	3½	24	4	13	1
5	0	19	4½	15	2	18	2	25	4	16	11½
6	1	3	3¼	16	3	2	0½	26	5	0	10
7	1	7	1¾	17	3	5	11¼	27	5	4	8½
8	1	11	0¼	18	3	9	9¾	28	5	8	7¼
9	1	14	10¾	19	3	13	8¼	29	5	12	5¾
10	1	18	9¼	20	3	17	6¾	30	5	16	4¼

Of the Uſe of the above TABLE.

When any Piece of Gold is adulterated with Silver, there will be a Deficiency in the Hydroſtatic Weight, which Deficiency muſt be found in the 1ſt, 5th, or 9th Columns of the above Table, then againſt it is the Value of the Gold that is wanting. As for Example, ſuppoſe I weighed a Piece of Gold, and found it to want 9 Grains in the Hydroſtatic Weight, I look into the firſt Column, and under Grains wanting I find 9, and againſt it is 1*l.* 14*s.* 10¾*d.* which is the Value of the Gold wanting, and ſo for any other Quantity.

To find of what Metal any Piece is made. 1*ſt*, Weigh it both in Air and Water, and note their different Weights.

2*dly*, From the Static Weight of the Body or Piece of Metal ſubtract its Hydroſtatic Weight, and with the Remainder divide the Static Weight, which will quote the Specific Gravity of the Body required.

3*dly*, Compare it with the Table of Specific Gravity, and you'll find what the Body is, or of what Metal any Piece is made.

N. B. This Rule is not only applicable to Metal Bodies, but 'tis univerſal for all Sorts of Bodies that will ſink in Water, let their Compoſition be what it will.

Example.

Admit I had a Piece offer'd me for a Guinea, which weigh'd in Air 5 Pennyweights 6 Grains, or 126 Grains; and in Water 4 Pennyweights 18.041 Grains, or 114.041 Grains, Quere of what Metal this Piece is made?

Grains
126 = weight in Air
114.041 = weight in Water

11.959 = Difference of Weights

```
            Grains
11.959) 126.000 (10.536 fere
        11959
        ─────
          64100
          59795
          ─────
           43 50
           35877
           ─────
            71730
            71754
            ─────
      Remains 24
```

The Quotient 10.536 I ſeek for in the firſt Column of the Table of Specific Gravity, where I find it to agree exactly with the Specific Gravity of Silver; from whence I conclude that the Metal is no better, and the Piece is worth no more than its Weight in Silver.

In like manner the Specific Gravity of a Piece of any other Weight or Metal may be found.

But when any Piece of Metal agrees in Static Weight with any of the Weights in the firſt Column of the enſuing Table, and in Hydroſtatic Weight with any of the four laſt Columns oppoſite, then we ſhall ſee by Inſpection of what Sort of Metal the Piece is made.

A

A TABLE ſhewing the Quality of the Metal by Inſpection.

Species.	Static Weight		Silver. Hydr. wt.		Copper. Hydr. wt		Braſs. Hydr. wt.		Tin. Hydr. wt.	
	pwt.	gr.	pwts.	gr.	pwts.	gr.	pwts.	gr.	pwts.	gr.
$\frac{1}{10}$ of a Moidore	0	$16\frac{2}{3}$	0	15	0	$14\frac{3}{4}$	0	$14\frac{1}{2}$	0	$14\frac{4}{5}$
$\frac{1}{8}$ of Ditto	0	$20\frac{3}{4}$	0	$18\frac{4}{5}$	0	$18\frac{1}{2}$	0	$18\frac{1}{3}$	0	18
$\frac{1}{8}$ of a Johannes	1	$3\frac{5}{8}$	1	1	1	$0\frac{1}{2}$	1	$0\frac{1}{4}$	0	$23\frac{4}{5}$
$\frac{1}{4}$ of a Moidore	1	$17\frac{1}{2}$	1	$13\frac{2}{3}$	1	$12\frac{9}{16}$	1	$12\frac{2}{3}$	1	$11\frac{9}{16}$
$\frac{1}{4}$ of a Johannes	2	$7\frac{1}{4}$	2	2	2	1	2	$0\frac{1}{2}$	1	$23\frac{3}{4}$
$\frac{1}{2}$ of a Guinea	2	$16\frac{1}{2}$	2	$10\frac{2}{5}$	2	$9\frac{1}{4}$	2	$8\frac{1}{2}$	2	$7\frac{2}{3}$
$\frac{1}{2}$ of a Moidore	3	$11\frac{1}{8}$	3	$3\frac{1}{4}$	3	$1\frac{4}{5}$	3	$0\frac{4}{5}$	2	$23\frac{3}{4}$
$\frac{1}{2}$ of a Johannes	4	$14\frac{1}{2}$	4	4	4	$2\frac{1}{8}$	4	$0\frac{4}{5}$	3	$23\frac{1}{5}$
a Guinea	5	9	4	$20\frac{3}{4}$	4	$18\frac{1}{2}$	4	17	4	$15\frac{1}{3}$
a Moidore	6	$22\frac{1}{4}$	6	$6\frac{1}{2}$	6	$3\frac{2}{3}$	6	$1\frac{3}{4}$	5	$23\frac{1}{2}$
a Johannes	9	5	8	8	8	$4\frac{1}{4}$	8	$1\frac{3}{4}$	7	$22\frac{4}{5}$
a 2 Guinea Pce	10	18	9	$17\frac{1}{2}$	9	13	9	$10\frac{1}{8}$	9	$6\frac{3}{4}$
a $2\frac{1}{2}$ Moidore Pce	17	$7\frac{1}{2}$	15	$16\frac{1}{8}$	15	9	15	$4\frac{1}{3}$	14	$22\frac{4}{5}$
a double Johannes	18	10	16	16	16	$8\frac{2}{5}$	16	$3\frac{2}{5}$	15	$21\frac{2}{3}$
a 5 Guinea Piece	26	21	24	$7\frac{3}{4}$	23	$20\frac{2}{3}$	23	$13\frac{1}{3}$	23	$3\frac{9}{16}$
a 5 Moidore Piece	34	$15\frac{1}{4}$	31	$8\frac{1}{3}$	30	18	30	$8\frac{2}{3}$	29	$21\frac{2}{3}$

The firſt Column of the above Table entitled Static Weight, contains the Weight of Gold Coins in Air according to the Names ſet againſt them; the four laſt Columns ſhew what they will weigh in Water, if made of Silver, Copper, Braſs or Tin, according to the Title of each reſpective Column.

Of

Of the Hydroſtatic Weight of SILVER.

The Specific Gravity of Silver is 10.536, which made leſs by 1, the Specific Gravity of Water leaves 9 536. So the Proportion for finding the Hydroſtatic Weight of any Piece or Maſs of Silver, will be as follows.

As 10.536 is to 9.536, ſo is the Static Weight of any Quantity of Silver to its Hydroſtatic Weight.

Example 1.

Suppoſe the Weight of a new Shilling in Air to be 3 Pennyweights 21 Grains, or 93 Grains, Quere how much it will weigh in Water?

```
                    Static Hydroſ.
                    Grains Grains     Pwts. Gr.
10.536 : 9.536 :: 93 : 84.17 = 3 : 12.17
            93
        ------
         28608
        85824
        ------
10.536)886.848(84.17
        84288
        ------
        43968
        42144
        ------
         18240
         10536
         ------
          77040
          73752
          ------
          3288
```

Example

Example 2.

Suppoſe a Piece of Silver weighed in Air 5 Pennyweights 9 Grains, or 129 Grains, how much will it weigh in Water?

```
          Static Hydroſ.
          Grains Grains         Pwts Gr.
as10.536:95.36 :: 129:116.756=4:20,756
             129
         --------
           85824
          19072
          9536
         ---------
10.536)1230.144(116.756
        10536
       --------
         17654
         10536
        --------
          71184
          63216
         --------
           79680
           73752
          --------
            59280
            52680
           --------
             66000
             63216
            --------
              2784
```

From whence it appears that the Hydroſtatic Weight of a new Shilling is 3 Pwts. 12.17 Gr. and that the Piece whoſe Static Weight in Air is 5 Pennyweights 9 Grains, will be 4 Pennyweights $20\frac{1}{4}$ Grains in Water. But for the Sake of whole Numbers, and to ſhorten the Work, we may inſtead of the Proportion of 10.536 to 9 536, make uſe of 21 to 19, which will come pretty near the Truth, as will appear by working the firſt Example over again.

Static Grains Hydroſ. Grains Pwts. Gr.

$$\text{as } 21 : 19 :: 93 : 84\tfrac{1}{7} = 3 : 12\tfrac{1}{7}$$

$$\begin{array}{r}
19\\ \hline
837\\
93\\ \hline
21)1767(84\\
168\\ \hline
87\\
84\\ \hline
3
\end{array}$$

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The Reſult by this Method is juſt the ſame as by the former; and as it is done with fewer Figures, and without the Help of Decimal Fractions, it may be eſteemed preferable to the other Way, eſpecially as it may be perform'd this Way by thoſe who are unacquainted with Decimal Arithmetic.

But in order to ſave Trouble, and to have the Weights always ready at hand, I have calculated the following Table, which by Inſpection will ſhew the Static and Hydroſtatic Weight of any Piece or Maſs of Silver, from one Shilling to three Pounds two Shillings in Value.

A TABLE of the Static and Hydroſtatic Weight of SILVER

Value			Static Weight.			Hydroſta. Weight.			Value			Static Weight.			Hydroſtatic Weight.		
l.	s.	d.	oz	pwt.	gr	oz.	pwt	gr.	l.	s.	d.	oz.	pwt.	gr.	oz.	pwt.	gr.
0	1	0	0	3	21	0	3	12	1	2	0	4	5	$3\frac{1}{2}$	3	17	$1\frac{3}{4}$
0	2	0	0	7	18	0	7	0	1	3	0	4	9	$0\frac{1}{2}$	4	0	1
0	3	0	0	11	15	0	10	$12\frac{1}{4}$	1	4	0	4	12	$21\frac{1}{2}$	4	3	13
0	4	0	0	15	12	0	14	$0\frac{1}{3}$	1	5	0	4	16	$18\frac{1}{3}$	4	7	1
0	5	0	0	19	$8\frac{1}{2}$	0	17	$12\frac{2}{5}$	1	6	0	5	0	$15\frac{1}{5}$	4	10	13
0	6	0	1	3	$5\frac{1}{2}$	1	1	$0\frac{1}{2}$	1	7	0	5	4	12	4	14	$1\frac{1}{4}$
0	7	0	1	7	$2\frac{1}{3}$	1	4	$12\frac{1}{2}$	1	8	0	5	8	9	4	17	$13\frac{1}{3}$
0	8	0	1	10	$23\frac{1}{5}$	1	8	$0\frac{2}{3}$	1	9	0	5	12	6	5	1	$1\frac{2}{5}$
0	9	0	1	14	20	1	11	$12\frac{3}{4}$	1	10	0	5	16	3	5	4	$13\frac{1}{2}$
0	10	0	1	18	17	1	15	$0\frac{4}{5}$	1	11	0	5	19	$23\frac{3}{4}$	5	8	$1\frac{1}{2}$
0	11	0	2	2	14	1	18	13	1	12	0	6	3	$20\frac{1}{2}$	5	11	$13\frac{2}{3}$
0	12	0	2	6	11	2	2	1	1	13	0	6	7	$17\frac{1}{2}$	5	15	$1\frac{3}{4}$
0	13	0	2	10	$7\frac{1}{2}$	2	5	13	1	14	0	6	11	14	5	18	$13\frac{4}{5}$
0	14	0	2	14	$4\frac{1}{2}$	2	9	1	1	15	0	6	15	$11\frac{1}{3}$	6	2	2
0	15	0	2	18	$1\frac{1}{3}$	2	12	$13\frac{1}{4}$	1	16	0	6	19	$8\frac{1}{5}$	6	5	14
0	16	0	3	1	$22\frac{1}{5}$	2	16	$1\frac{1}{4}$	1	17	0	7	3	5	6	9	1
0	17	0	3	5	19	2	19	$13\frac{1}{2}$	1	18	0	7	7	2	6	12	13
0	18	0	3	9	16	3	3	$1\frac{2}{5}$	1	19	0	7	11	0	6	16	$1\frac{1}{4}$
0	19	0	3	13	12	3	6	13	2	0	0	7	14	23	6	19	$13\frac{1}{3}$
1	0	0	3	17	10	3	10	$1\frac{1}{2}$	3	0	0	11	12	9	10	9	$14\frac{5}{6}$
1	1	0	4	1	$6\frac{3}{4}$	3	13	$0\frac{3}{4}$	3	2	0	12	0	0	10	13	12

If any Piece or Maſs of Silver, when weigh'd in Air and Water, agrees both in Static and Hydroſtatic Weight with the foregoing table, we may be ſure that the Silver is genuine. But if it agrees with the Static Weight, and falls ſhort in the Hydroſtatic Weight, it is certain that it is in ſome Manner adulterated.

Now by knowing how much any Piece of Silver is deficient in the Hydroſtatic Weight, the Value of that Deficiency, or the Worth of the ſilver that is wanting, may be found in the following Manner.

It has already been found that a new Shilling, weighing 3 Pennyweights 21 Grains, or 93 Grains in Air, will weigh 84.17 Grains in Water; now we will find how much the ſame Weight of Braſs will weigh in Water.

Static Grains — Hydroſ. Grains

8.1 : 7.1 :: 93 : 81.52 fere==Weight of Braſs.

71

93

651

8.1)660.3(81,51

648

123

81

420

405

150

81

60

	Grains
From	84.17 = Wt. of 93 Gr. of Silver in Water.
Subtract	81.52 = Wt. of 93 Grains of Braſs in Water.
Difference	= 2.65 = Grains deficient in the Braſs Piece.

Hence we ſee that the greateſt Difference poſſible of two Pieces of Silver and Braſs, whoſe Weight in Air are 93 Grains, will be but 2.65 Grains when weighed in Water. Therefore if 2.65 Grains amount to one Shilling, what will one Grain amount to at that Rate ?

Grains deficient		d.		Grain deficient	d.
2.65	:	12	::	1	$4\frac{1}{2}$ = Value of one Grain.

4

2.65)48.00(18.2 = $4\frac{1}{2}$*d.*
265

2150
2120

30

By which I find that every Grain that is deficient in the Hydroſtatic Weight of any Piece or Maſs of Silver, depreciates its Value juſt Fourpence halfpenny, and ſo in Proportion for a greater or leſſer Quantity, as follows.

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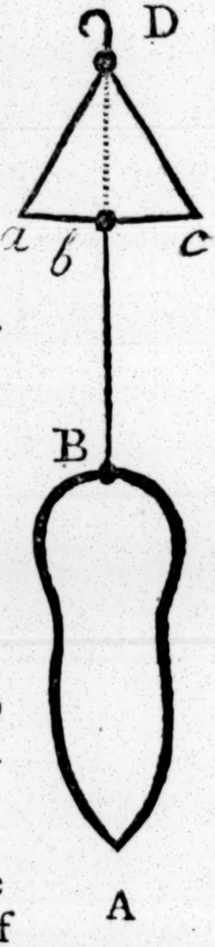
			l.	s.	d.
The Deficiency of	1 Grain	is worth	0	0	4½
	1 Pennywt.		0	9	0
	1 Ounce		9	0	0

Having fully explained the Nature and Manner of proving of Gold and Silver by the Laws of Hydroſtatics, and ſhewn how the leaſt Adulteration may be diſcovered, how much of one Sort, and how much of another is mixed together, alſo how much any Piece or Maſs of Gold, *&c.* is depreciated by ſuch a Mixture, to the minuteſt Part of a Grain, the whole being laid down in as plain and intelligible a Manner as the Nature of the Subject would admit, I ſhall in the next Place reduce the Theory into Practice, by laying down proper Rules, and adding ſome eaſy Examples, whereby any one, of but an ordinary Capacity, will be enabled to make any Experiments, in order to try the Goodneſs, or prove the Value of any Piece of Gold or Silver that he may be in doubt of.

But firſt of the Requiſites neceſſary to make Experiments.

1 You muſt be furniſhed with a Set of Gold Weights, with Pennyweights, Grains, a half, and a quarter of a Grain, and a good

Pair of Scales, the truer the Beam the better, for thereby you may come to a greater Nicety in your Trials.



2. You muſt alſo be provided with an Hydroſtatic Inſtrument, ſuch as the annexed Figure, which conſiſts of a Pair of Pincers to hold the Piece when it is immerſed in Water, and a little Scale for laying of Grains on, if occaſion, to balance the Beam when the Piece of Gold, *&c.* is ſuſpended in the Water.

The Pincers, which is the lower Part from A to B, may be made with a Piece of large braſs Wire, of about three Inches in Length, turn'd as in the Figure, ſo as to meet with a Spring at the Point A to hold the Piece of Money, *&c.*

The little Scale *a b c* may be made of thin Lead or Braſs, of about an Inch and Half Diameter, and hung by Strings to the Hook D.

The Scale and Pincers may be faſtened together by a fine Braſs Wire, Silk, Thread, or Horſe Hair, which is repreſented in the Figure by the Line B *b*. This Inſtrument is to be hung on to one End of your Beam, in the room of one of your Scales, which muſt be taken off when you weigh any Thing in Water.

The whole Length of this Inſtrument muſt be made ſomewhat leſs than your common Scales, which may be done by making the Wire or Thread from B to *b* longer or ſhorter, as Occaſion ſhall require.

N. B. Care muſt be taken to adjuſt the Weight of the Hydroſtatical Inſtrument, ſo as to be exactly in Equilibrio with the fixed Scale when the Pincers are juſt covered with Water at B.

Of the Method of uſing the Scales, &c.

Firſt, Find the exact Weight of the Piece of Gold, *&c.* in the uſual Way in the Air, which note; then take off one of your Scales, and in its Place hang on the Hydroſtatical Inſtrument before deſcribed.

Secondly, Put the Piece of Gold, *&c.* into the Pincers, and let it be immerſed in a Glaſs or Tumbler of fair Water.

Thirdly, Lay Weights in the fixed Scale ſufficient to cauſe the arms of the Beam to be level, when the Pincers containing the Piece of

Gold are juſt covered with Water, which Weight likewiſe note.

Or if it be a Piece of Gold Coin that you are weighing, it will be beſt to put its proper Weight in the fixed Scale, and balance it by laying Weights on the little Scale, which Weights will be the Difference.

Now if theſe two Weights found, *viz.* the Static and Hydroſtatic Weight of the Piece of Gold, agree, when compared with the Tables in this Book according to their Title; or if the Difference agrees with the Column of Difference in the Table, Page 18, then you may depend on the Gold, *&c.* being genuine, and in no wiſe adulterated. On the contrary, if it falls ſhort in the Hydroſtatic Weight, or the Difference is more than it ought to be by the Tables, it is certain that it is ſome Way or other adulterated.

But by knowing the Grains deficient in the Hydroſtatic Weight, we ſhall find by the Table of Deficiency how much the Piece of Gold, *&c.* is depreciated in Value by the Adulteration.

N. B. Care muſt be taken to keep the Piece from touching any Part of the Glaſs, by letting the Pincers containing the Piece ſuſpend freely in the Water.

Example 1.

Suppoſe I had a Mind to try the Static and Hydroſtatic Weight of a Guinea.

Firſt I weigh the Guinea the uſual Way in Air, by putting it in the moveable Scale, and its proper Weight againſt it in the other Scale, which ſuppoſe it exactly to balance. Then I take off the Scale in which the Guinea is, and in its Place hang on my Hydroſtatical Inſtrument. Then I put the Guinea into the Pincers, and ſuſpend it in Water, and lay on ſo many Grains in the little Scale as will cauſe the Arms of the Beam to be level, which we will ſuppoſe here to be $6\frac{7}{8}$ Gr. or nearly 7 Grains; with this Difference, *viz.* $6\frac{7}{8}$ I look into the laſt Column of the Table, Page 18, where I find it exactly to correſpond with the Difference there ought to be between the Static and Hydroſtatic Weight of a Guinea. Therefore I conclude the Gold is good, and in no wiſe adulterated, it being full Weight both in Statics and Hydroſtatics.

Example 2.

Admit a Guinea to weigh 5 Pennyweights 6 Grains in Air, and 4 Pennyweights $23\frac{1}{3}$ Grains in Water, *viz.* whoſe Difference of Weights is $6\frac{2}{3}$ Grains, *Quere*, Whether the Gold is good or not?

Theſe Weights compared with the Table in Page 18, ſhew that the Guinea is 3 Grains too light by the Static Weight, and nearly as much by the Hydroſtatic Weight; but ſince the Difference of its Weight in Air and Water does not vary much from the Difference in the Table, we may be certain that the Gold is good, and not at all adulterated.

Hence we may obſerve, that a Piece of Gold when weigh'd in Air and Water may fall ſhort of the fixed Weights in the Tables, and not be adulterated, as in the laſt Example of the Guinea, which was too light by 3 Grains in both Weights, which depreciates its Value about 6*d.* but then in ſuch Caſes the Deficiency will be nearly alike in both Weights, that is, as 19 is to 18.

Example 3.

Suppoſe a Guinea weighed in Air 5 Penny-weights 9 Grains, and in Water 5 Penny-weights $\frac{1}{5}$ Grain, Quere how much Gold there is in it?

Theſe Weights compared with the Table, Page 18, ſhew that the Guinea is full weight according to Statics, but wants two Grains in the Hydroſtatic Weight, which by the Table of Deficiency, Page 26, amounts to 7*s.* 9*d.* ſo that the Gold that is contained in this Piece is worth but 13*s.* and 3*d.*

Example 4.

Suppoſe a Guinea to weigh in Air 5 Pennyweights 9 Grains, as before, and in Water but 4 Pennyweights 20¾ Grains, Quere what the Gold is worth?

By comparing it with the Table, Page 18, it appears that it is full weight by Statics, but is deficient 5⅜ Grains in the HydroſtaticWeight, which being reduced by the Table of Deficiency, Page 26, will amount to 1*l.* 10*d.* which is nearly as much as a Guinea is worth, therefore I conclude there is no Gold in it at all, but is made of ſome other Metal; now in order to find of what Metal it is made, I compare it with the Table, Page 29, where I find the HydroſtaticWeight, anſwerable to its Static Weight, exactly to agree with the Column titled Silver; from whence it appears that its Value is no more than its Weight in Silver:

	pwts.	*gr.*		
and if it weigh'd	4	18½	it would be	Copper
in Air 5 *pwts.* 9 *gr.*	4	17		Braſs
and in Water -—	4	15⅓		Tin

Example 5.

Suppoſe a Piece call'd a Johannes weigh'd in Air 9 pwts. 5 gr. and in Water 8 pwts. 8 gr. Quere of what Metal it is made?

By comparing this with the Table, Page 18, I find a Deficiency of $9\frac{1}{3}$ gr. in the Hydroſtatic Weight, which reduced by the Table of Deficiency, Page 26, will amount to *1l.* 16*s.* $2\frac{1}{2}$*d.* therefore no Part of it can be Gold, but it muſt be made of ſome baſer Metal; whence by comparing it with the Table, Page 29, I diſcover it to be Silver, for the Hydroſtatic Weight againſt its Name ſtands in the Column titled Silver:

	pwts.	*gr.*		
and if it weigh'd	8	$4\frac{1}{4}$	it would be	Copper
in Air 9 *pwts.* 5 *gr.*	8	$1\frac{3}{4}$		Braſs
and in Water —	7	$22\frac{4}{5}$		Tin

Example 6.

Suppoſe any Piece or Maſs of Gold weigh'd in Air 14 pwts. 6 gr. and in Water 13 pwts. 12 gr. Quere whether the Gold is equal to Standard, and how much the Value of it in Money?

With the Static Weight I look into the Table, Page 17, where in the Column under Static Weight I find 14 pwts. 6 gr. and againſt it under Hydroſtatic Weight I find 13 pwts. 12 gr. which ſhews the Gold to be Standard; and the Value of it I find (by the Column of Value) to be 2*l.* 17*s.*

In like manner you may prove the Goodneſs of any other Piece of Gold whatſoever.

Example 7.

Suppoſe a Piece of Silver weigh'd in Air 2 oz. 10pwts. 7½gr. and in Water 2 oz. 5 pwts. 13 gr. Quere if it be equal in Goodneſs with the Standard, and how much it is worth in Money?

With the Static Weight I look into Table, Page 33, entitled the Static and Hydroſtatic Weight of Silver, where in the Column of Static Weight I find 2 oz. 10 pwts. 7½ gr. and againſt it under Hydroſtatic Weight 2 oz. 5 pwts. 13 gr. from whence it appears that it is of equal Goodneſs with the Standard, and is worth 13*ſ.* in Money, as ſpecified in the Column of Value.

Example 8.

Suppoſe a Piece of Silver to weigh in Air 3 oz. 17 pwts. 10 gr. and in Water 3 oz. 9pwts. 5½ gr. Quere whether it is equal in Goodneſs to Standard, and how much it is worth?

With the Static Weight I have recourſe to the Table, Page 33, where I find 3 oz. 17 pwts. 10 gr. and againſt it under Hydroſtatic Weight 3 oz. 10 pwts. 1½ gr. which is 20 grains more than the Piece of Silver weigh'd in Water; ſo that it is 20 gr. deficient of Standard Silver.

Now if it were Standard Silver it would be worth 20*s.* as by the Column of Value, but 20 gr. Deficiency, at 4$\frac{1}{2}$*d.* a Grain, amounts to 7*s.* 6*d.* ſo that the Value of the Piece of Silver will be juſt 12*s.* 6*d.* See Page 35.

In like manner the intrinſic Value of any other Piece of Silver may be found, to the greateſt Exactneſs.

Upon the whole we ſee, that tho' Gold or Silver be adulterated in the moſt artful manner poſſible, yet the Cheat may be diſcover'd by the Laws of Hydroſtatics, and the intrinſic Value of the Metal may be found to the greateſt Exactneſs poſſible.

Theſe Scales with the Hydroſtatical Inſtrument will anſwer the End of an Hydroſtatical Balance, whereby a great many uſeful Experiments may be made, in finding the Specific Gravities of ſuch Bodies whoſe Specific Gravities are unknown.

But then in ſome Caſes it will be beſt to take off the Pincers, and faſten the Body to the Thread or Wire of the Inſtrument.

A Glaſs Drop will alſo be neceſſary for finding the Specific Gravities of Fluids, that is, a Piece of ſolid Glaſs in Form of a Heart or Wedge, the more eaſily to ſeparate the Parts of thoſe Fluids into which it ſhall be immerſed.

This Piece of Glaſs ſhould be faſtened at its Baſe to the Wire or Thread of the Inſtrument, and ſo exactly equipoiſed, when immerſed in Water, as to keep the Beam at a level.

But for Mercury Powders, or ſmall Fragments of Bodies, they muſt be weigh'd in a glaſs or metal Bucket, of ſuch a Weight as when ſuſpended and immerſed in Water to a certain Depth, it will exactly counterpoiſe the fixed Scale in the Air.

Being furniſhed with the above Requiſites, you may apply them to the finding of the Specific Gravities of all Sorts of Bodies, whether Solids or Fluids, whether they are lighter or heavier than Water.

For ſuch Bodies as will ſink in Water, I have already, on Page 29, ſhewn the Method of finding their Specific Gravities: I ſhall now ſhew how to find the Specific Gravities of ſuch Solids as are lighter than Water, which is effected in the following Manner.

1. Weigh the light Body in Air, which Weight note.

2. Weigh the Piece of Metal, *&c.* in Water, and note its Weight.

3. Faſten the light Body to a Piece of Metal, or ſome other heavy Body of known Specific Gravity, that will cauſe them to ſink together in Water, then weigh them together in Water, and note that Weight alſo.

Then the Rule is as follows:

Add the Static Weight of the light Body in Air to the Weight of the Metal in Water, from their Sum ſubtract the Weight of the Compound in Water, then with the Remainder divide the Static Weight of the light Body, and the Quotient will be the Specific Gravity of the Body ſought.

Example.

Admit a Piece of Yew-tree Wood to weigh in Air 10 pwts. 12 gr. = 252 gr. to which I tack a Piece of fine Braſs, whoſe Weight in Water ſhall be 12 pwts. or 288 gr. and ſuppoſe the Weight of both together in Water to be 8 pwts. 19 gr. or 211 gr. Quere the Specific Gravity of the Wood?

Grains
252=ſtatic wt. of the wood
288=hydroſtatic wt. of the braſs

Sum = 540
Subtract = 211 =wt. of the compound in water

329)252.0(,766
2303

2170
1974

1960
1975

15

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By which I find the Specific Gravity of Yew-tree-wood to be ,766; nearly the ſame as in the Table of Specific Gravity. In like manner the Specific Gravities of other ſolid Bodies lighter than Water may be found.

To find the Specific Gravity of Fluids.

Take a Solid whoſe Specific Gravity is known, ſuch as the Glaſs Drop is beſt, and weigh it both in Air and Water, noting the Difference, which Difference multiply by the Specific Gravity of the Metal, *&c.* and the Product divide by its Static Weight; then the Quotient will be the Specific Gravity of the Fluid required.

Example.

Suppoſe I had a mind to try the Specific Gravity of Sea Water, with a Drop made of common Glaſs, whoſe Weight in Air is 8 Pennyweights, or 192 Grains; and ſuppoſe it weigh'd in ſalt Water 4 Pennyweights $18\frac{1}{2}$ Grains, or $114\frac{1}{2}$ Grains, *Quere* the Specific Gravity of the Water?

Grains
192=Static wt. of my Glaſs Drop
114.5=Hydroſtatic Weight

77.5=Difference
2.552=Specific Gravity of Glaſs

1550
3875
3875
1550

192)197.7800(1.03
192

578
576

Remains 2

By which it appears that the Specific Gravity of Sea Water is nearly 1.03 the ſame as in the Table of Specific Gravity; and in like Manner the Specific Gravity of any other Fluid may be found.

But if you are not provided with a Glaſs Drop, you may inſtead thereof adjuſt a Piece of common Glaſs to weigh juſt eight Pennyweights in Air, which may be held in the Pincers when immerſed in any Fluid.

Special Care muſt be taken to balance the fixed Scale, and the Pincers (which are adjuſted to Water only) in each reſpective Fluid, for the Weight of the Pincers will vary when immerſed in different Fluids, accordingly as the Fluids are lighter or heavier than Water.

This Piece of Glaſs will be of good Uſe in proving the Strength of Spirits, Brine, Lees, *&c.* for if it be immerſed in the following Fluids it ſhould weigh in each of them according to the Weights ſet againſt their reſpective Names, *viz.*

		pwt.	gr.
In	Aſh Lees	4	$8\frac{1}{5}$
	Made Brine	4	$12\frac{1}{2}$
	Sea Water	4	$18\frac{1}{2}$
	Common ditto	4	$20\frac{3}{4}$
	Diſtilled Waters	4	$21\frac{1}{3}$
	Brandy or Malt Spirits	5	$2\frac{1}{4}$
	Spirits of Wine	5	$6\frac{4}{5}$

If on making the Experiment in any Fluid heavier than Water, the Glaſs ſhould weigh more than the above Weights, it would ſhew that the Fluid was under Proof, or weaker than it ought to be; on the contrary, if it ſhould weigh leſs than the above Weights, it would ſhew it to be above Proof, or ſtronger than the Standard.

But when the Experiment is made in Fluids of a ſpirituous Nature, then the Caſe will be quite the reverſe, for the ſtronger the Spirit the leſs will it reſiſt or buoy up the immerſed Solid, and conſequently the more it will weigh therein. And on the contrary, the weaker the Spirit the heavier it will be, and therefore the more buoyant; and the greater the Reſiſtance of the Fluid, the leſs will the Weight of the Solid be when it is immerſed and weighed therein.

Of the Uſe of the Table of Specific Gravity.

I ſhall here, in as brief a Manner as I am able, point out ſome of the excellent Uſes that may be made of the Table of Specific Gravity at the Beginning of this Book, particularly in the finding of the Capacities or ſolid Contents of Meaſures; as alſo of ſuch Bodies whoſe irregular Form may render them very difficult, if not impoſſible, to be meaſured by any other Method whatſoever. So that any Perſon, unſkill'd in the Art of Menſuration, by this

Means will be enabled to find the Solidity of thoſe Bodies inſerted in the Table of Specific Gravity, to the greateſt Nicety imaginable; nay, in many Caſes with more Accuracy than it can it be done by any Kind of Meaſurement whatſoever.

Before I proceed it will be neceſſary to conſider the Capacities, or ſolid Inches contained in the ſeveral legal Meaſures uſed in *England*, and what thoſe Commodities are which are bought and ſold by each of them; as that muſt be our Guide to direct us to find how many of any Denomination are contained in a given Weight.

There are three different Meaſures of Capacity made uſe of, two of them for meaſuring all Sorts of Liquids, and the other for meaſuring of dry Goods. Their Solidities, *&c.* are as follow.

1. *Of Wine Meaſure.*

In a Wine Gallon there are contained 231 ſolid Inches, and ſo in Proportion for a greater or leſſer Quantity, as may be ſeen by the following Table.

By this Meaſure, Wine, Brandy, Spirits, Strong Waters, Cyder, Perry, Mead, Honey, and all Sorts of Oil are meaſured.

A TABLE of WINE MEASURE.

	Species.	Cubic Inches in each.	Averdupoiſe Weight when full of Water.		
			lb	oz.	drac.
A	Hogſhead	14553	526	5	13
	Gallon	231	8	5	11
	Quart	57.75	2	1	$6\frac{3}{4}$
	Pint	28.87	1	0	$11\frac{3}{8}$
	Half Pint	14.44	0	8	$5\frac{7}{8}$
	Quarter of ditto	7.22	0	4	3
	Half Quartern	3.61	0	2	$1\frac{1}{2}$

2. *Of Wincheſter Meaſure.*

In a Gallon of this Meaſure are contained 282 Cubic Inches, and ſo in Proportion for a greater or leſſer Quantity, as may be ſeen by the following Table. By this Meaſure Ale, Beer, Milk, Water, *&c.* are meaſured.

A TABLE of Wincheſter Meaſure.

	Species.	Cubic Inches in each.	Averdupoiſe Weight when full of Water.		
			lb	oz	drach.
A	Gallon	282	10	3	3
	Pottle	141	5	1	$9\frac{1}{2}$
	Quart	70.5	2	8	$12\frac{3}{4}$
	Pint	35.25	1	4	$6\frac{3}{8}$

3. *Of Dry Meaſure.*

In a Buſhel of this Meaſure are contained 2150.42 Cubic Inches, and ſo in Proportion for a greater or leſſer Quantity, as will appear by the following Table.

By this Meaſure all Sorts of Grain, Malt, Seeds, Salt, Sand, Flower, are meaſured.*

A TABLE of DRY MEASURE.

	Species.	Cubic Inches in each.	Averdupoiſe Weight when full of Water		
			[illegible]	[illegible]	drach
A	Buſhel	2150.42	77	12	8½
	Peck	537.60	19	7	2
	Gallon	268.80	9	11	9
	Pottle	134.40	4	13	12½
	Quart	67.20	2	6	14¼
	Pint	33.60	1	3	7⅛

The three laſt Tables will be of uſe in trying and adjuſting of Meaſures to the Standard, for if the Meaſure be tared, and filled full of Water, and then weighed in a good Pair of Scales, its Weight, if juſt, will agree with the Weight in the Table againſt its Name; and if it weighs more than by the Table it is above Meaſure, but if leſs it is under Meaſure.

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* Coals are alſo ſold by this Meaſure, but then it is provided by Act of Parliament, that the Coal Buſhel ſhall be made 18½ Inches Diameter throughout, and ſhall contain eight Gallons and one Quart of Water, which is equal to 2217.62 Cubic Inches.

By having the Weight of any Piece or Maſs of any Body, inſerted in the Table of Specific Gravity, to find its Solidity.

Rule.

Reduce the Weight given, whether it be Troy or Averdupoiſe, into Ounces, which divided by the reſpective tabular Number for a cubic Inch of that Body, will quote the Number of Inches contained in the given Weight. And if the cubic Inches be divided by its reſpective Number in the firſt Column of the three foregoing Tables, you will find how many Hogſheads, Buſhels, Gallons, *&c.* are contained in it, or by 1728 (the Number of Inches in a ſolid Foot) the Number of Feet.

Example 1.

Suppoſe I weighed a certain Quantity of Honey, whoſe neat Weight Averdupoiſe was exactly three Pounds, *Quere*, How much is the meaſure of it?

16=Ounces in a Pound
3=Pounds of Honey

Decimal of a Cubic Inch of Honey.
.839115)48.000000(57.2=Solid Inches
4195575
6044250
5873805
1704450
1678230
26220

By which I find that in three Pounds of Honey there are contained near $57\frac{1}{4}$ Solid Inches, which is nearly equal to the Inches contained in a Quart Wine Meaſure, as by Table.

Example 2.

Suppoſe a certain Quantity of Olive Oil weigh'd 7 lb. 10 oz. Averdupoiſe, *Quere*, How much will it meaſure?

16=Ounces
7=Pounds

112
10

122=Number of Ounces

Decim. of a Cubic Inch of Olive Oil.

.528353)122.000000(230.9=Solid Inches
1056706

1632940
1585059

4788100
4755177

32923

By which it appears that in 7 lb. 10 oz. of Olive Oil, there are contained nearly 231 Solid Inches, which by the Table of Wine Meaſure is the Number of Inches contained in a Gallon, which was required.

Example 3.

Suppoſe the Averdupoiſe Weight of a Piece of Brazil Wood to be 128 lb. 14 oz. *Quere*, How many ſolid Feet it contains?

128=Pounds
16

768
128
14

Decimal of a Cubic Inch of Brazil Wood

.596638)2062.000000(3456=Sol. Inches
1789914

2720860   1728)3456(2=Feet
2386552   3456

3343080   0000
2983190

3598900
3579828

19072

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From whence it appears that 128 lb. 14 oz. of Brazil Wood contain juſt two Feet, which was required.

In the ſame Manner the Solidities of any other Body, inſerted in the Table of Specific Gravity, may be ſound.

The Solidity of any Body, whoſe Specific Gravity is unknown, may be found alſo in the following Manner.

Weigh the Body in Air and Water noting the Difference, which Difference divide by the Tabular Number for a Cubic Inch of Water, viz. by .5275 if Troy, or .5787 if Averdupoiſe

Weight, and the Quotient will ſhew the Number of Cubic Inches in the Body required.

Or thus, Reduce the Difference of Weights in Air and Water into Grains or Drachms, and then the Diviſor for Troy will be 253, nearly equal to the Grains in a Cubic Inch of Water; and for Averdupoiſe 148, nearly equal to the Drachms in a Cubic Inch of Water; which former, divided by the latter, will quote the Solidity of the Body weighed.

Example.

The different Weights of a five Moidore Piece of Gold in Air and Water is 1 pwt. 20 gr. or 44 Grains, I want to know its ſolid Content.

```
     Grains
253)44.0(.1739=Solid Content
    253
    ----
    1870
    1771
    ----
     990
     759
    ----
     2310
     2277
    ----
       33
```

By which it apears that the Solidity of a five Moidore Piece is .1739 Parts of 10.000, or about the $\frac{1}{6}$ of an Inch ſolid. The like for any other Body whatſoever.

By having the Solidity of any Body given, to find its Weight either in Troy or Averdupoiſe.

Rule.

Reduce the Solidity given into Inches, which multiply by the Tabular Number for a Cubic Inch of that Body, and the Product will be the Weight in Ounces, either Troy or Averdupoiſe, according to the Factor taken.

Example.

Suppoſe it were required to find the Troy and Averdupoiſe Weight of a ſolid Foot of Box Wood.

For Troy.	For Averdupoiſe.
.543325=Factor	.596061=Factor
1728=Inches in a Ft.	1728=Inches in a Ft.
4346600	4768488
1086650	1192122
3803275	4172427
543325	596061
12)938,865600=Ounces	16)1029,993408=Ounces
78.2.8656=Pounds,&c.	64.5.993408=Pounds, &c.

From whence it appears that a ſolid Foot of Box Wood will weigh 78 lb. 2.8656 oz. Troy, and 64 lb. 5.993408 oz. Averdupoiſe Weight, which was required.

In like Manner the Weight of any Body whoſe Name is included in the Table of Specific Gravity, and whoſe Solidity in Feet, Inches, *&c.* is known, may be found very exact either in Troy or Averdupoiſe Weight.

F I N I S.

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